SCHOOL OF ECONOMICS AND MANAGEMENT

The impact of Swedish monetary policy: Is the Swedish Riksbank losing control over consumer price inflation?

Master Thesis I

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Abstract

Monetary policy has been suggested to show a fading impact on domestic inflation. Based on this, the study tests whether this has occurred with Swedish monetary policy over the period January 2000 – January 2020. This is done by studying the impact of monetary policy on consumer price inflation and real estate prices in Sweden, comparing the results to the United States. The used method consists of local projections for computing the impact of monetary policy shocks on the economy. Furthermore, the measure of monetary policy shocks is developed by using the measure constructed by Romer & Romer (2004). The results for Swedish consumer price inflation support the general findings of the literature, asserting that the impact of domestic monetary policy on domestic consumer price inflation has decreased. However, the responses of U.S. consumer price inflation differ. The impact on changes in both Swedish and U.S. real estate prices is less clear. There is a potential presence of a Cantillon Effect in the developments of the responses of consumer price inflation and real estate prices. Yet, the unclear findings for real estate prices reduce the effect's feasibility as an explanatory factor.

Keywords: Monetary policy, local projections, Cantillon Effect, inflation.

1. Introduction

The impact of domestic monetary policy on domestic inflation is a topic in the macroeconomic literature that has been studied emphatically alongside a growing, interconnected, global economy. The interest in how independent monetary policy can be performed by a central bank to attain objectives of price, financial, – and output stability are clearly alive within the related research field, and rightfully so given its relevance for current policymaking.

Recent trends indicate that domestic inflation has begun to respond less to domestic monetary policy. At the same time, it appears to be more reactive to global economic developments (Auer, Borio, & Filardo, 2017; Borio & Filardo, 2007). During the latest three decades, the literature appears relatively united on the notion that monetary policy appears to be fading in its grip on domestic inflation. However, the range of suggested causal factors behind such a process is more widespread.

One example of this development can be observed in Sweden. The inflation target set in 1993 marked the beginning of a new monetary policy regime in the country. The purpose of the

inflation target was to attain low and stable inflation in addition to a well-functioning payment system. The new monetary regime has generally been successful at reducing fluctuations in consumer price inflation and inflation expectations. In fact, average CPI inflation was stable around one percent between 1997 – 2014 (Andersson & Jonung, 2020; Calmfors, 2015; Riksbanken, 2018).

From 2013 and onwards, the Swedish Riksbank has conducted a more expansive monetary policy, determined to maintain the set annual inflation target of two percent. In February 2015, the Riksbank set negative policy rates to achieve the inflation target. In addition, quantitative easing has been conducted. These measures of monetary policy were controversial given the deviation from the policy rate set by the ECB, in addition to the unique decision to set a negative policy rate for the first time in the bank's history (Andersson & Jonung, 2020; Calmfors, 2015).

Despite these expansive measures, the Riksbank struggled to reach the annual inflation target of two percent during this period up until 2019. The pattern can be observed in *Figure 1.1*. The period of negative interest rates from the Riksbank was characterized by a struggle of raising the consumer price inflation, measured by the target variable consumer price inflation with a fixed interest rate (CPIF), to an annual two percent change. At the same time, changes in other inflationary trends, such as real estate prices, have been reacting positively and began to surge after having stabilized between 2010 – 2012. This motivates the question of whether the domestic monetary policy by the Swedish Riksbank has decreased in its impact on consumer price inflation over time and increased in its impact on asset prices (Andersson & Jonung, 2020).

The relevance of this topic is founded on the need for additional explanations of reductions in the impact of domestic monetary policy on domestic consumer price inflation. Common theoretical explanations behind this development, such as the flattening of the Phillips curve, global inflation, and expectations can, in turn, be traced to several various factors. These vary from economic integration, demographics, integrated labor markets, etc. The literature is largely united on the implications of phenomena such as global inflation, the flattening of the Phillips curve, and expectations on monetary policy. Yet, there is a large diversity regarding the factors which cause these phenomena (Auer et al., 2017; Blanchard, 2016; Conti, Neri & Nobili, 2017; Kuttner & Robinson, 2008).

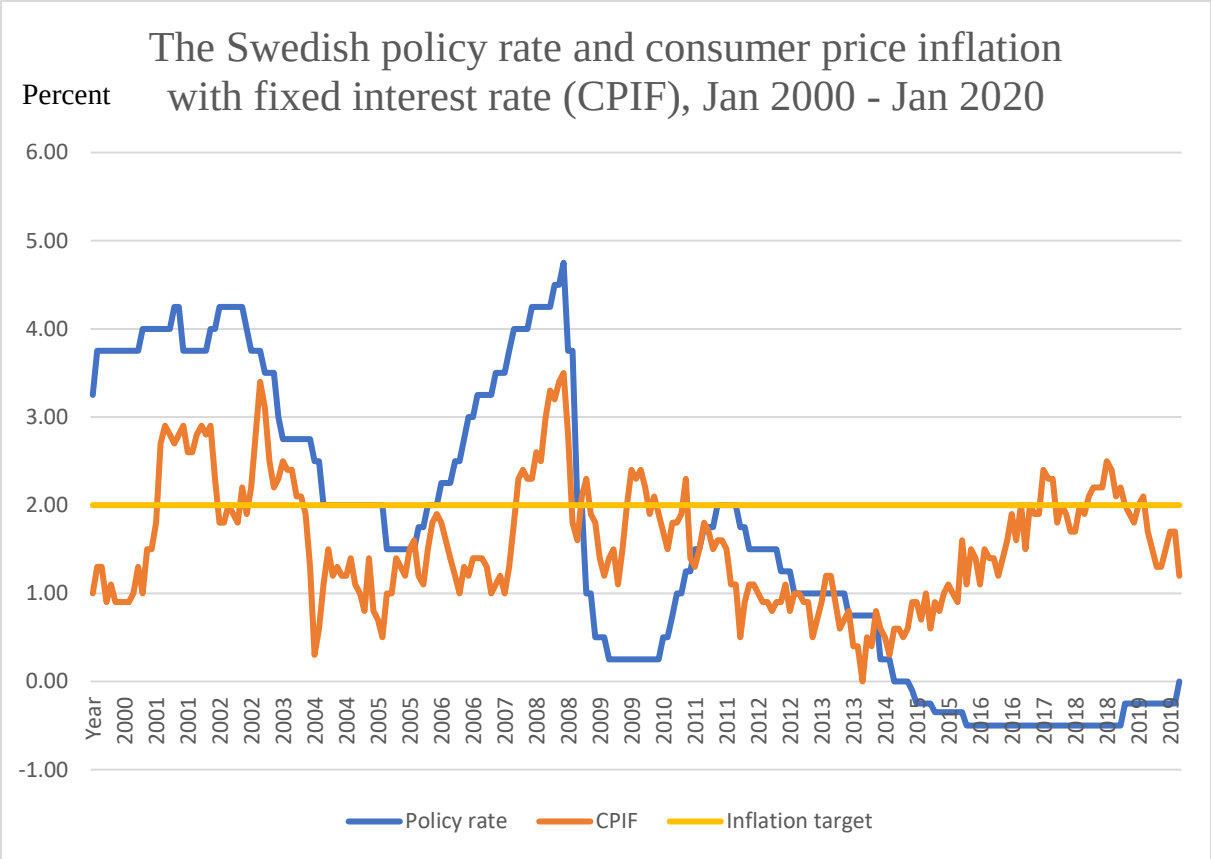


Figure 1.1. The development of the Swedish policy rate and consumer price inflation with a fixed interest rate (CPIF) in relation to the inflation target, January 2000 – January 2020. Source: Ekonomifakta (2021).

Thus, a key objective of this study is to enrich the existing debate about the factors causing the fading impact of monetary policy on domestic inflation. Another objective is to investigate the impact of the Swedish policy rate on consumer price inflation. This impact appears to have changed over the course of the years and it is necessary to study whether this is the case. Furthermore, the causal factors behind such developments need to be evaluated. Extending the debate about possible factors behind faltering domestic monetary policy the work can benefit the work of policymakers active within monetary policy. This includes the work of institutions such as central banks and, given the focus on Swedish monetary policy, not least for the Swedish Riksbank.

One suggested factor, in addition to the ones mentioned above, which may be contributing to fading domestic monetary policy influence on consumer price inflation is the Cantillon Effect. It implies that an increase in the money supply in the economy affects the relative prices received (Hagemann & Trautwein, 1998). The Cantillon Effect will constitute the piece from

this study that is suggested to be added to the possible explanations behind the decreasing impact of domestic monetary policy.

The purpose of this thesis is to study whether there has been a decrease in the impact of the Swedish policy rate on consumer price inflation and an increase on real estate prices from January 2000 – January 2020. It also includes investigating the feasibility of the Cantillon Effect as a potential explanatory factor, alongside several others, behind such a development. Based on this purpose, the research question for the thesis emerges as the following: Has there been a decrease in the impact of the Swedish Riksbank's monetary policy on consumer price inflation and an increase in its impact on real estate prices? The formulation of the main hypothesis to test in this thesis is as follows: There has been a decrease in the impact of the Swedish Riksbank's monetary policy on consumer price inflation and an increase in its impact on real estate prices.

The idea to investigate whether Swedish monetary policy has decreased in influence on consumer price and increased on asset price inflation is founded on the observations of Andersson & Jonung (2020). The authors present how the negative policy rates set by the Swedish Riksbank between 2015 – 2019 had a relatively weak response from the consumer price inflation impact of the Swedish monetary policy on consumer price inflation. At the same time, the housing market responded with surging prices (Andersson & Jonung, 2020).

Regarding the methods, this study will use a measure for the impact of monetary policy developed by David & Christina Romer (2004). Their measure is generated by the residuals of a linear regression of changes in the intended funds rate based on previous levels of the funds rate and forecast data of inflation, GDP, and unemployment. It has proved to be more significant with respect to its impact on inflation in the economy and less endogenous, compared to a broader version of it (Romer & Romer, 2004). It will be described in more detail in Chapter 2.

The estimations of the impact of the monetary policy measure by Romer & Romer (2004) will be conducted by local projections, a method developed by Òscar Jordà (2005). The method carries advantages such as being more robust to misspecification of the unknown data-generating process when estimating impulse responses. They consist of univariate equations and are relatively easy to estimate in statistical software packages (Brugnolini, 2018; Jordà, 2005). The local projections are used in this work to compute the impulse responses of several prices in the economy to Swedish monetary policy, particularly inflation in consumer prices and real estate prices. The studied sample period ranges from January 2000 – January 2020. It

is also divided into smaller subsamples to conduct a more thorough analysis of the development of the responses of consumer price inflation and real estate prices. There is a large width to additional prices considered, including share prices and export- and import price indices. A comparison will be made to the responses of consumer price inflation and real estate prices to monetary policy in the United States economy.

The results from the local projections indicate that the impact of Swedish monetary policy has indeed changed to some extent over the studied period. The development of the responses for Swedish consumer price inflation is relatively clear as they appear to decrease over the sample period. However, for Swedish real estate prices, the changes are less clear, as they appear to increase over the sample period when studying the subsamples of it. However, the largest response appears around the middle of the sample period and not at the end. A comparison of the impact of monetary policy on consumer inflation and real estate prices in the United States illustrates a different picture of the monetary policy impact. U.S. consumer price inflation shows indications to start increasing at the end of the sample period. The responses of U.S. real estate prices are, like their Swedish counterparts, less clear. The findings will be explored in more detail in Chapters 3 and 4.

The structure of the work consists of the following: The introduction is followed by a presentation of the related literature and theory within this field. After this, the methodology is revealed, followed by a presentation of the results. Then the discussion of the findings ensues. The thesis is ended with a main conclusion.

2. Literature review

The issue of a decreasing impact of domestic monetary policy on domestic inflation assumes an initial capability of central banks to affect inflation. Therefore, the review of the literature will begin with a referral to the 'trilemma' formulated by Obstfeld & Taylor (2004), whose implications are that monetary policy can affect the economy under certain conditions. This is followed by further research about the factors explaining a decrease in the impact of monetary policy. The relevant literature will be critically evaluated and analyzed, and gaps for future research will be identified.

2.1. The trilemma

An important aspect to consider when studying the influence of monetary policy is the actual assumption that it is possible to affect the economy using this form of policy. A foundation for such an assumption can be found in the trilemma formulated by Obstfeld & Taylor (2004). The trilemma asserts that independent monetary policy in a world of free movement of capital requires floating exchange rates, at the same time as floating exchange rates enable the independence of monetary policy (Obstfeld & Taylor, 2004; Rey, 2015). From a different perspective, this system implies that it is not possible to analyze the global capital markets without considering global labor markets, global trade, domestic macroeconomic policy, and foreign exchange regimes. One example of these relations is presented by Williamson (2007) who argues that world labor markets and capital movements are intertwined in that capital has followed migrating labor forces in the pursuit of resources and land (Williamson, 2007).

The trilemma proposed by Obstfeld & Taylor (2004) constitutes one way of thinking about the independent monetary policy as reliant on certain conditions, but if these are fulfilled, they should enable its functionality. Yet, there are criticisms brought forward against the trilemma's validity. Hélène Rey (2015) argues that the concept is a 'dilemma' rather than a trilemma. This implies that a global financial cycle of capital flows, credit growth, and asset prices constrains the domestic monetary policy. An important determinant of this global financial cycle is the monetary policy in the center country, such as the U.S., which transmits credit growth, credit flows, and changes in leverages among global financial institutions such as banks. These channels for these flows and leverages in turn transport monetary conditions on a global scale. Thereby, there is a dilemma where domestic monetary policy can be conducted only if the capital account is managed, regardless of whether the exchange rate is fixed or floating.

Suggestions for managing the capital account ranges from capital controls, stricter leverage limits, and macroeconomic measures to limit credit growth (Rey, 2015). Having introduced a foundation for an influence of monetary policy on the domestic economy, several possible factors behind its decreasing impact will now be evaluated.

2.2. Globalization of inflation

One of the factors behind a fading impact of domestic monetary policy on domestic inflation that the global economy has influenced the ability of central banks to steer their domestic inflation through their monetary policy. The hypothesis of 'globalization of inflation' suggests a relationship between domestic inflation and global channels, hence indicating that it is necessary to consider global trends when managing domestic inflation. The debate around this hypothesis concerns the causality for this hypothesis. Auer et al. (2017) suggest global value chains (trade of goods and services), others argue that integrated labor markets constitute an important factor, while others stress common policies. Fluctuations at business cycle frequencies are also suggested as explanatory factors (Auer et al., 2017; Ciccarelli & Mojon, 2006). Despite the disagreements regarding the causality, the findings for a covarying relationship between domestic inflation rates is generally accepted in academia (Ciccarelli & Mojon, 2006). Hence, it appears plausible to refer to the potential influence of global economic factors when studying the impact of central banks' monetary policy.

One example of this can be related to the case of Sweden, which has a clear economic integration with the EU economies. Half of the country's exports go to the member countries, and Sweden has connected supply chains for industries that even do not export to the EU to the framework of the European economy (Andersson & Jonung, 2020). In an article of the newspaper Dagens Industri (2017), the Governor of the Swedish Riksbank, Stefan Ingves, stated the importance of the European Central Bank's (ECB) policy for Sweden at a conference at the Western Swedish Chamber of Commerce in October 2017, claiming that “we are neighbors next to an elephant and when the elephant moves it affects us.”- Stefan Ingves, Dagens Industri (2017). The Governor stated at the same conference that a low policy rate at the European Union meant the Swedish Riksbank had to follow in their tracks.

Likewise, Andersson and Jonung (2020) argue that the Riksbank eventually abandoned this adjusting monetary policy to the ECB during 2015 – 2019 as it adopted negative policy rates. The Riksbank's adopted monetary policy was more expansionary compared to both the one decided by the ECB and the American Federal Reserve (Andersson & Jonung, 2020).

Another claim suggests that a more effective and better monetary policy is a vital reason behind more stable inflationary trends observed in the last three decades across the globe (Borio & Filardo, 2007). The regime from the 1980s was indeed, up until the Great Recession, perceived as very successful in terms of monetary policy when considering price stability (Goodhart, 2011). Borio & Filardo (2007) do add that a complementary explanation behind current inflation trends consists of international reasons, such as the integration of the world economy, adding the argument of a global-centric approach (Borio & Filardo, 2007).

2.3. Flattening of the Phillips curve

A common factor suggesting the fading impact of monetary policy relates to a phenomenon described over the years as the flattening of the Phillips curve.[1] The implications from this famous result assert that bolstering the economy should lead to rises in inflation. However, given the recent period of low inflation, despite a more stable economy, one suggested factor would be that this relationship implied by the slope of the Phillips curve has become flatter over time (Occhino, 2019).

Several studies conducted by Smets and Wouters (2007), Kuttner & Robinson (2008), and Auer et al. (2017) have investigated the phenomenon of a flattening Phillips curve, where the assumed causal relationship between unemployment rates and inflation is questioned. Smets and Wouters (2007) use a dynamic stochastic general equilibrium (DSGE) model to show this and refer to indications of stronger price and wage stickiness in their results. Kuttner and Robinson (2008) argue in their study of a standard structural New-Keynesian Phillips curve that a similar, flattening trend is occurring. Suggested factors such as globalization in addition to data problems are proposed (Auer et al., 2017; Kuttner & Robinson, 2008; Smets & Wouters, 2007).

Possible reasons behind these observed phenomena of a flattening Phillips curve have been claimed to range from globalization, economic integration, common policies, etc. (Kuttner & Robinson, 2008; Auer et al., 2017). The extensive range of suggested factors behind this phenomenon is a reminder of the limited factors that will be considered in this study regarding the developments of a lower impact of domestic monetary policy on domestic inflation.

[1] The Phillips curve was constructed by A.W. Phillips (1958). This finding proposed a negative relationship between inflation and unemployment (Phillips, 1958).

Altogether, the flattening of the Phillips suggests another challenge for monetary policy steered from an independent central bank to maintain price stability in the domestic economy (Andersson & Jonung, 2020).

2.4. Expectations

One factor that may cause the changes in the Phillips curve and hence lower inflation is the anchoring of expectations. The accelerationist Phillips curve states that lagged inflation can be used as a proxy for inflation expectations, and this was a relatively stable predictor for the actual inflation trends in the 1970s and 1980s. However, an anchoring of expectations such that inflation expectations turn relatively stable should show a decreasing relationship between lagged inflation in previous periods. This would indicate less reliance on the accelerationist Phillips curve for explaining inflationary developments. Kiley (2015) explores this phenomenon in the United States during two periods, 1976 – 1995 and 1996 – 2014. He discovers that the relationship between expected and lagged inflation weakened from the first to the second period (Kiley, 2015).

Mishkin (2007) extends the reasoning by pointing to that inflation expectations measured as public expectations in percent turned from being relatively high at the start of the 1980s but have decreased ever since. From 1998 this measure of inflation expectations remained remarkably stable (Mishkin, 2007). Blanchard (2016) asserts that expected inflation responds less to unemployment and that this trend has been present since the 1980s. Reasons behind this may consist of the credibility of monetary policy as well as the long period of low inflation. Its impact on the accelerationist Phillips curve, and hence monetary policy, presents problems for the conduct of monetary policy in the future (Blanchard, 2016).

The observed phenomena of stabilizing inflation expectations may contribute to explaining declines in inflation in the 21st century. Yet, it cannot account for all the decrease in inflation and needs to be considered with additional factors which cause a flattening of the Phillips curve. These include wage rigidity, structural changes in the New-Keynesian Phillips curve, and a stronger commitment of monetary policy to price stability (Kiley, 2015).

2.5. The Cantillon Effect

The flattening of the Phillips curve is an important aspect of the fading influence of monetary policy on domestic inflation. Another aspect concentrates on the structural channels within the economy in the form of money supply and how it in turn affects inflation. This relates to the

proposition that the Swedish Riksbank has through its monetary policy inflated asset prices while only carrying a mild effect on target consumer price inflation, causing different sorts of inflation. This leads us to one of the main possible factors behind this observed trend in the Swedish economy.

For this study, a suggested, potential, explanation behind a decreasing effect of Swedish monetary policy on consumer price inflation is the Cantillon Effect, developed by Richard Cantillon. If there is an increase in the monetary base in the economy, this ensures that people will have more money to spend, which in turn will lead to increased expenditures and savings. The higher circulation of money in the economy in turn leads to rising prices for commodities, land, and labor. The transmission mechanism of the Cantillon Effect suggests that a rise in money in the economy will alter the structure of prices, incomes, and consumption in the economy (Hagemann & Trautwein, 2006).

Furthermore, it was presented earlier that it is possible to observe simultaneous trends of inflated asset prices and sticky consumer price inflation in the Swedish economy, which can be viewed in *Figure 1.2*. This could entail that the expansionary monetary policy of the Swedish Riksbank has contributed to inflating the asset markets compared to the consumer prices. This may be related to how the increasing money supply enters the economy, suggesting that the Cantillon Effect may constitute a factor for the inflating housing market and the sticky consumer price inflation. Studying whether this effect may be feasible as a potential contributing factor to fading monetary policy impact on inflation constitutes a central piece of the purpose of this study.

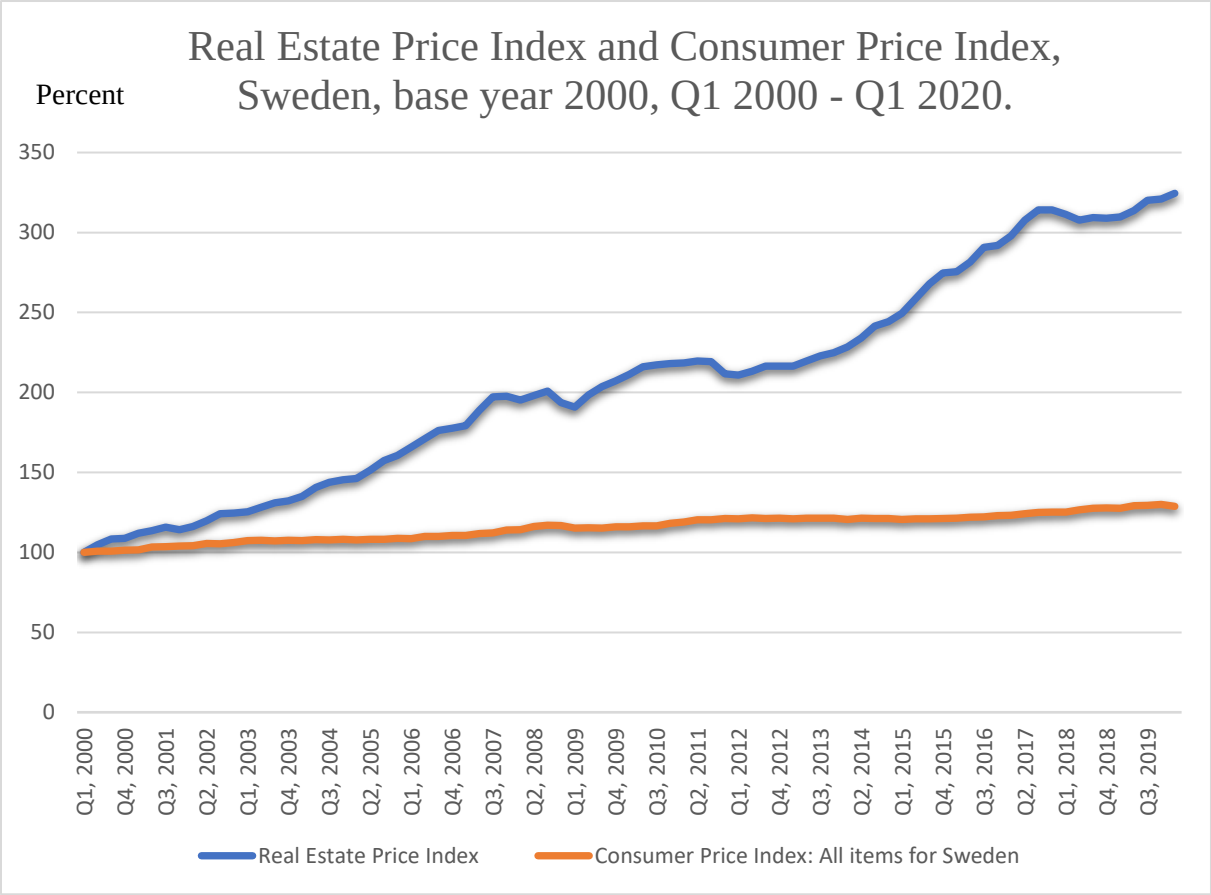


Figure 2.1. The developments in Swedish Consumer Price Index (CPI) and Real Estate Price Index, Q1 2000 – Q1 2020. Sources: Ekonomifakta (2021); Federal Reserve Economic Database (FRED) (2021).

The presented literature review provides an overall framework for the factors affecting the relationship between domestic monetary policy and domestic inflation. In general, the overarching agreements are that domestic monetary policy is fading in its influence on domestic inflation. However, the variety of explanatory factors behind this phenomenon offers more room to maneuver regarding contributions to current research. In the next chapter the methodology within the relevant literature, as well as this study's attempt to measure the impact of monetary policy in Sweden, will be introduced.

3. Methodology

The methodology for macroeconomics contains an ample variety of approaches with respect to both modeling and data. Regarding the data, time series econometrics have become common methods in topics related to economic dynamics and forecasting (Enders, 2010). Other forms of data, such as panel data, have been used in macroeconomics to explore heterogeneous differences in cross-country data (Gavin & Theodorou, 2003). Examples of techniques used in empirical time series are represented mainly by the generalized method of moments (GMM) method, the standard-and structural vector-autoregressive models (VAR, SVAR) as well as methods using two-stage least squares and two-stage least squares as an optimal instrumental variable (IV) estimator (Christiano, 2012; Hansen & West, 2002; Jordà, 2005).

Bruce E. Hansen & Kenneth D. West (2002) presents a survey of empirical techniques used in empirical time series between 1990 to 2000. Least squares were developed by Theil (1953) and Basmann (1957) and the IV estimation was founded by Sargan (1958, 1959). Between 1990 and 2000 the usage of these techniques decreased in empirical time series. On the contrary, GMM methods increased in their popularity as an empirical technique. Conditional moments are inherent in several dynamic optimizing models applied in macroeconometrics, such as Euler equations, and in forecasting models. In the survey from Hansen & West (2002), fifty percent of articles using GMM in 2000 were used for dynamic optimization (Hansen & West, 2002). One example of this consists of the work of Alan, Attanasio, and Browning (2009) who deploy GMM to estimate a nonlinear Euler equation for consumption to deal with measurement errors (Alan, Attanasio & Browning, 2009).

Yet, the introduction of VAR models by Christoper A. Sims (1980) remains crucial for the four decades of macroeconomic methodology that followed (Sims, 1980; Christiano, 2012). VAR models have been deployed for tasks such as forecasting, constructing economic models, and evaluating policy action. Especially model selection has been a very successful area where the VAR models have made their contributions. One of the areas where they have been very active is to guide the construction of New-Keynesian models who in turn are capable of mimicking estimated impulse responses from structural vector autoregressive models (SVAR) (Christiano, 2012) The VAR model is also a common method when estimating the effects of monetary policy. For example, this can be viewed from Romer & Romer's (2004) choice to compare their study with the VAR literature by selecting a VAR model to estimate the effect from their estimated measure of monetary policy shocks (Romer & Romer, 2004).

3.1. Local projections

Contrary to the methods outlined above, this paper has decided to apply local projections to estimate the impact of domestic monetary policy on domestic inflation (Jordà, 2005). The selection of local projections builds firmly on the work by Jordà (2005). These models estimate impulse responses through univariate equations and make repeated computations for each individual period in the sample. The impulse responses consist of functions of forecasts over increasing time horizons, where misspecification errors are compounded with the increasing time horizon (Jordà, 2005).

The motivation behind the usage of local projections is the robustness they inherit against model misspecification, adaptability to nonlinear data, and the relative simplicity of using local projections. The data-generating process is unknown and the fewer assumptions about it the better. The robustness of local projections to misspecifications of the data-generating process makes them attractive in this context. HAC robust standard errors can also be used to obtain valid inference for the local projections (Jordà, 2005). However, local projections are less efficient than the VAR model if it is the true data-generating process and is correctly specified. Brugnolini (2018) also presents evidence that local projections need small samples to be competitive with the VAR (Brugnolini, 2018). Again, Jordà's (2005) results do assert that even though the true model is a correctly specified VAR, it only performs marginally better in terms of efficiency than local projections. For example, in a system of six variables, 12 lags, and 24 periods, the difference in efficiency, measured by Newey-West standard errors, is almost non-existent (Jordà, 2005).

Based on these insights about the adopted method's properties, the local projections will estimate the impacts of the monetary policy on the dependent price indices as impulse responses. From these impulse responses, interpretation, inference, and discussion will follow. The explanatory variable, consisting of monetary policy shocks, is obtained based on the measure developed by David H. Romer & Christina D. Romer (2004), whose outline will now be presented.

3.2. Monetary policy shocks

Furthermore, the measure of monetary policy used in this study has been inspired by the measure developed by Romer and Romer (2004). This specific measure consists of the residuals from a regression on the Federal Open Market Committee's (FOMC) changes in the intended funds rate on forecasted inflation, real output growth, and unemployment rate. The idea is to

purge all the decisions of the FOMC related to its information about developments in the economy which are influencing the changes in the intended funds rate, for example, economic forecasts (Romer & Romer, 2004).

The new measure yields highly significant results of the impact of monetary policy on inflation, compared to another, broader measure of changes in the actual funds rate which has a relatively lower significant impact on inflation. The broader measure shows a significantly weaker correlation between monetary and real developments. With the broader measure, the impact of monetary policy is lower, slower, and less significant, compared to the new measure of monetary policy shocks derived through the residuals. Romer and Romer (2004) argue that this indicates strong endogeneity between the broader measure of changes in the actual federal funds rate and behavior of the FOMC based on information about developments in the economy. This implies that some of the impact of monetary policy on real activity may be concealed (Romer & Romer, 2004).

Given the motivation by Romer & Romer (2004) behind the use of the purged measure of changes in the intended funds rate, this study will adopt a similar measure. The reason is, as stated above, to decrease the endogeneity between the changes in policy rates and the behavior of the decision-makers based on information. This measure will explain the impact of monetary policy on consumer price and asset inflation in Sweden and the United States.

3.3. Data & statistical tools

The time series data for the sample of January 2000 – January 2020 formed the overall dataset for the study. The lower limit of the sample was set given that the Swedish Riksbank had adopted a new monetary policy regime of inflation targeting in 1993 and the first years consisted of the Riksbank testing and learning the new monetary framework (Andersson & Jonung, 2018). The upper limit was set given the global pandemic of COVID-19 and the potential noise this may include on the data and the behavior and policy from central banks.

The data for Sweden was collected from databases belonging to Statistics Sweden (2021), the Swedish Riksbank (2020), Ekonomifakta (2021), and the Federal Reserve Economic Database (FRED) (2021). The data for the United States were imported from the FOMC:s Greenbook forecasts, Tealbooks, and projection materials from the Chairman's Press Conferences at the Federal Reserve's website (2021) as well as from FRED (2021).

The data was collected and formatted in two steps: Initially, forecast and policy rate data were collected from respectively monetary policy reports for the Swedish forecast data. For the American forecast data, Greenbook forecasts were used from January 2000 up until January 2010 when they were replaced by Tealbooks, who in turn were later replaced by projections from the Chairman's FOMC Press Conferences. These forecast data were formatted into changes in percentages to match the units of the changes in policy rate and previous level policy rate included in the same data set.

The second step consisted of importing data sets for the dependent variables, constituted by price indices, and the control variables, which were represented by GDP, unemployment rates, consumer price index, and housing prices. Most of the data for Sweden was imported as monthly data which was converted into quarterly data through quarterly averages. The U.S. data could immediately be imported in quarterly form and no formatting was required. The estimated monetary policy shocks were included in the same dataset as the dependent variables and the control variables. Furthermore, given that the units for the explanatory variable, the monetary policy shocks, are changes in percent, all the data was formatted into percentage changes and then computed into changes in percent, or percentage points.

Regarding statistical tools used in the study, STATA constituted the main software for obtaining the relevant measures and the results used to test the hypothesis of a falling impact of monetary policy in Sweden regarding consumer price inflation. Microsoft Excel was used to format and organize the data, as well as to create some graphical illustrations.

3.4. Monetary policy shocks in practice

The process of estimating the impact of monetary policy on consumer price inflation and housing prices in Sweden and the United States was constituted by two main steps. The first step in the process was to obtain the measure of monetary policy shocks proposed by Romer & Romer (2004). The measure is obtained through filtering out endogenous variables in the adopted monetary policy by the FOMC, which are related to information such as forecasts and their systematic effects on the policy, thereby isolating what the authors label as 'monetary policy shocks'. These shocks are claimed to have a more profound and faster impact on the economy. This paper aims to adopt the methods used by Romer & Romer (2004) in isolating shocks related to monetary policy decisions, free from information-related systemic responses (Romer & Romer, 2004).

Hence, the order of operations of generating the measure began with the collection and formatting of time series data for policy rates imported from Ekonomifakta (2021) and FRED (2021). Then, Swedish and American forecast data on inflation and output was imported from the monetary policy reports of the Swedish Riksbank (2020) for the Swedish data, and from the Greenbook forecasts, Tealbooks, and the projection materials of the Chairman's FOMC Press Conferences. The selection of the data of forecasted inflation and GDP was taken from the Swedish Riksbank and the FOMC:s archives of monetary policy reports (in the case of the Swedish Riksbank) and meetings (in the case of the FOMC) (Riksbanken, 2021; Federal Reserve, 2021).

The collection of the forecast data from the reports are based on a quarterly rule, where the reports from February – March, May – June – July, September – October, and December for Sweden have been used for the data collection. In the December reports, the forecast data for Q1 the following year is obtained, in the February – March reports the Q2 forecasts are retrieved, and so on. For the FOMC meetings, the data collection from the Greenbook forecasts, Tealbooks, and the Chairman's FOMC Press Conferences was conducted in a similar manner (Federal Reserve, 2021).

The forecasted GDP variable consists of yearly percent changes, estimated for each quarterly monetary policy report from the Swedish Riksbank and the Greenbook forecasts and the projections from the Chairman's FOMC Press Conferences. The forecasted inflation for Sweden was imported as yearly percent change, formatted as monthly data, which was converted into quarterly averages and then changes in percent. The measures for the Swedish inflation forecasts consist of measures of UND1X and KPIX up until July 2008, where they were replaced by the KPIF (CPIF). [2] In contrast, the U.S. counterpart measure of forecasted inflation uniformly consists of the Federal Reserve's target variable PCE [3] over the entire sample.

The forecasted GDP and inflation data were obtained as annual percent change both for the Swedish and the American data. They were later converted into changes in percent to be

[2] UND1X is a measure of a consumer price index which excludes household mortgage interest expenditure and effects of changes in indirect taxes and subsidies. KPIX became the new name of UND1X in November 2007, the definition of the measure remained the same as before. It was phased out in June 2008 (Riksbanken 2007, 2008; Statistics Sweden 2021).
KPIF is a measure of consumer price index (CPI) with a fixed interest rate. This measure was introduced in July 2008 to correct for the effect changes in the policy rate have on mortgage rates, which in turn influence the CPI measure (Riksbanken, 2021).
[3] Personal Consumption Expenditure (PCE) measures the personal consumption expenditures of households (Federal Reserve, 2019).

coherent with the units for respectively, the changes in the policy rate and the federal funds rate, and the levels of these the previous period (see the equation below).

The monetary policy reports from the Swedish Riksbank from December 1999 – December 2004 are characterized by some lack of consistently updated forecasts for GDP growth in Sweden for every quarter. This has led to certain simplifications such as using some forecasts for a longer period and selecting forecast data that consisted of contributing factors to GDP growth. The main rule for all the forecast data across the entire sample from Q1 2000 – Q1 2020 has been to use forecasts dated before the concerned quarters, but some parts of the forecast data have been gathered from reports submitted shortly after the forecasted quarters, especially from Q1 2001 – Q4 2003.

Once the forecast and policy rate data had been collected and formatted for both Sweden and the United States the next step consisted of importing the data to the statistical software STATA. From here, a linear regression on changes in the policy rate was estimated on the forecast data and the previous level of the interest rate, similar to the regression estimated by Romer and Romer (2004), only leaving out the unemployment forecasts. The reasons behind this were to use GDP as a proxy for the influence of the unemployment rate on changes in the policy rate. One of the reasons for Romer & Romer (2004) to derive their measure of monetary policy shocks is to get a better measure for the impact of monetary policy on real activity in the economy (Romer & Romer, 2004). The obtained GDP forecasts can be used to represent the real activity, and thus, they should suffice to cover for the absence of unemployment rate forecasts.

The quarterly change in the policy rate was labeled as the dependent variable, $\triangle \mathrm{rt}$, and regressed on the policy rate level the previous quarter, $\mathrm{rt}-1$, forecasted GDP growth, $\triangle \mathrm{yt}$, and forecasted consumer price inflation, $\triangle \pi \mathrm{t}$.

$$\triangle rt = rt - 1 + \triangle yt + \triangle \pi t + \varepsilon t$$

The observed regression results, presented in *Table 4.1* below, yielded a positive relationship between the changes in the policy rate and forecasted GDP growth, inflation, and the previous level of the policy rate. Furthermore, the coefficient for forecasted GDP growth is statistically significant, while the ones for forecasted inflation and the previous level of the policy rate are not. This is consistent with the work of Romer & Romer (2004), who report that inflation forecasts initially have an overall small effect on changes in the U.S. federal funds rate (Romer & Romer, 2004).

In contrast, forecasted GDP growth has a highly significant impact on the changes in the policy rate, suggesting countercyclical behavior from the Swedish Riksbank regarding forecasted GDP growth. Again, this is consistent with the findings of Romer & Romer (2004), who also infer countercyclical behavior from the FOMC based on their estimates of how output growth forecasts impact changes in the federal funds rate (Romer & Romer, 2004). Finally, the level of the policy rate in the previous period is not significant for the changes in the policy rate.

Moreover, to extract the monetary policy shocks for the local projections, the residuals of the regression above were predicted and then imported as the pure monetary policy shocks. Again these are policy shocks that are not dependent on information for the respective boards when they make their decisions regarding the monetary policy and are thereby consistent with the measure Romer & Romer (2004) propose in their work (Romer & Romer, 2004).

Table 3.1. The regression from which the monetary policy shock measure developed by Romer & Romer (2004) was obtained for the Swedish data. Source: Ekonomifakta (2021), Riksbanken (2020).

Changes in policy rate (dep.), Sweden	**Coefficient**	**Standard Error**	**t**	**p > |t|**
Previous policy rate	0.0031	0.0229	0.14	0.891
Forecast, GDP	0.1539***	0.0307	5.02	0.000
Forecast, inflation	0.0882	0.0525	1.68	0.097
Constant	-0.4854***	0.1217	-3.99	0.000
R-squared	0.257	Adj. R-squared	0.2281	

p* < 0.05, p** < 0.01, p*** < 0.001

3.5. Local projections in practice

Given our new estimates for monetary policy shocks, the explanatory variable has been obtained to study the impact of monetary policy on inflation. Thereby, the second step was initiated, where impulse responses of the impact of the policy rate on various price indices were generated through local projections. This will be the method used to test the hypothesis of a decrease in the impact of Swedish monetary policy on consumer price inflation as well the increasing effect on real estate prices.

The local projections were set up used to compute impulse responses for the impact of monetary policy on inflation for the different prices for up to three years ahead. The computations are based on the following equation,

$$yt + h - yt = c + \beta h * mt + kt + \varepsilon t$$

where $yt + h$ is the dependent variable, mt is the monetary policy shock, and kt are different control variables which include the lags of yt. Here, h constitutes the number of periods studied between January 2000 to January 2020, and βh is the impact of a monetary policy shock on the dependent variable for h periods. The variation in the number of h forecasted periods regarding the impact of monetary policy will be limited to a maximum of 12 periods. The selection of the lags was based on two factors: 1) the time horizon that the Swedish Riksbank (2020) has for reaching close to its inflation target is two years (the additional four lags gives some flexibility), and 2) local projections will be biased over longer time periods, even with control variables (Herbst & Johannsen, 2020). Finally, robust standard errors were used which is consistent with Jordà (2005) (Jordà, 2005).

The control variables, kt, consist partly of the lagged dependent variables for the respective prices. The rest are represented by real GDP growth, unemployment rate, housing prices, and share prices in Sweden and the United States from Q1 2000 – Q1 2020. They were imported from Ekonomifakta (2021) and FRED (2021). The simulation of the impact of monetary policy on consumer and asset price inflation in Sweden consisted of both Swedish and U.S. control variables. Contrary to this, the comparative simulation for the U.S. was restricted to using control variables only from the United States, given the assumed, relatively low influence from the Swedish economy on the American one.

This completes the chapter on methodology. As the selected method, data, and the practical process for this study have been presented we can now turn to the estimated results. These will be introduced in the following chapter.

4. Results

The results from the local projections of the effect of monetary policy shocks on changes in CPIF, real estate price index and, additional price indices for Sweden and the United States are presented in *Tables 4.1 – 4.2* below. Initially, the overall findings of the impact of the Swedish Riksbank's monetary policy on domestic consumer price inflation and real estate prices are presented. They are followed by the main results related to the research question and the hypothesis of this study. This segment will include an investigation of the influence of monetary policy on the Swedish economy over two smaller samples, ranging from January 2000 – January 2010, and January 2010 – January 2020, respectively. Finally, a comparative section for the development of the monetary policy impact in Sweden and the United States will be presented.

4.1 Swedish monetary policy impact: January 2000 – January 2020

General inference for the relationship between Swedish monetary policy, consumer price inflation, and changes in real estate prices can be drawn from the linear regressions in *Tables 4.1 – 4.2*, based on Ordinary Least Squares (OLS) standard errors. It suggests that the monetary policy shocks, derived from the method presented by Romer & Romer (2004), are statistically significant as a factor in changes in real estate prices. In contrast, the shocks are not statistically significant on the inflation target variable CPIF. These initial findings suggest that monetary policy shocks have an insignificant influence on the target variable CPIF and a significant influence on housing prices in the Swedish economy. However, these findings do not address the main hypothesis of a decreasing impact of the Swedish Riksbank's monetary policy on consumer price inflation and an increasing impact on real estate prices over time.

The results for the actual impact of monetary policy shocks over time on consumer price inflation and real estate prices are depicted in *Figures 4.1 – 4.2*. Here, the impact of one unit of a monetary policy shock on CPIF and real estate prices in Sweden is estimated in percentage units for up to twelve quarters ahead across January 2000 – January 2020. The number of quarters is constituted by the number of lags for the explanatory variables. It is worth to mention that the estimated impact of a monetary policy shock on these results was not significant for neither the consumer price inflation nor the real estate price responses. The only exception was for the monetary policy shock impact on CPIF after four quarters.

Table 4.1. General impact of the derived monetary policy shocks measure by Romer & Romer (2004) on consumer price inflation in Sweden, January 2000 – January 2020. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

CPIF (dep.), Sweden	Coefficient	Standard Error	t	p > |t|
Monetary policy shocks	0.7551	0.3964	1.9	0.061
Control SWE GDP	0.0817	0.0524	1.56	0.123
Control SWE unemployment	-0.0106	0.0102	-1.04	0.301
Control SWE real estate prices	-0.0264	0.0265	-0.99	0.324
Control SWE share prices	0.0007	0.0001	1.1	0.275
Control U.S. GDP	0.1075	0.0695	1.55	0.126
Control U.S. unemployment	0.0527	0.1584	0.33	0.74
Control U.S. housing prices	0.0026	0.0119	0.22	0.828
Control U.S. share prices	-0.0002	0.0000	-0.07	0.948
Constant	0.0298	0.0488	0.61	0.543
R-squared	0.2113	Adj. R-squared	0.1113	

The observed trend of the impact of a monetary policy shock on CPIF in *Figure 4.1* depicts a relatively higher volatility for the first five periods, which includes the fourth period with a significant effect. For the last seven periods, the impact of the shock is statistically insignificant and the response of the CPIF appears less volatile. It also seems to decrease in value. The responses from real estate prices to a similar shock in *Figure 4.2* also register fluctuations across most of the period, yet at no point across the twelve quarters is there a statistically significant effect from the shock. In general, the values of the responses of real estate prices appear relatively higher than the values of the responses from CPIF from a monetary policy shock.

Table 4.2. General impact of derived monetary policy shocks measure by Romer & Romer (2004) on changes in real estate prices in Sweden, January 2000 – January 2020. The control variable for Swedish real estate prices has been left out due to collinearity. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

Real estate prices (dep.), Sweden	Coefficient	Standard Error	t	p > |t|
Monetary policy shocks	-3.8224	1.7040	-2.24	0.028
Control SWE GDP	0.4364	0.2271	1.92	0.059
Control SWE unemployment	0.0390	0.0452	0.86	0.392
Control SWE share prices	0.0003	0.0003	0.91	0.366
Control U.S. GDP	0.0902	0.3087	0.29	0.771
Control U.S. unemployment	-0.1096	0.7041	-0.16	0.877
Control U.S. housing prices	0.0308	0.0526	0.59	0.559
Control U.S. share prices	0.0000	0.0001	-0.01	0.99
Constant	-0.1188	-0.2164	-0.55	0.585
R-squared	0.1506	Adj. R-squared	0.0562	

Accompanying these results are the findings of the impact of monetary policy on an additional set of prices in the Swedish economy, illustrated in *Table 4.3* in the Appendix. These price variables include responses from share prices, export, and import price indices (EXPI & IMPI), the producer price index (PPI), and the factor price index (FPI). Observing the results in *Table 4.3* yields indications of a statistically significant influence of monetary policy shocks on share prices, as well as on FPI to a minor extent.

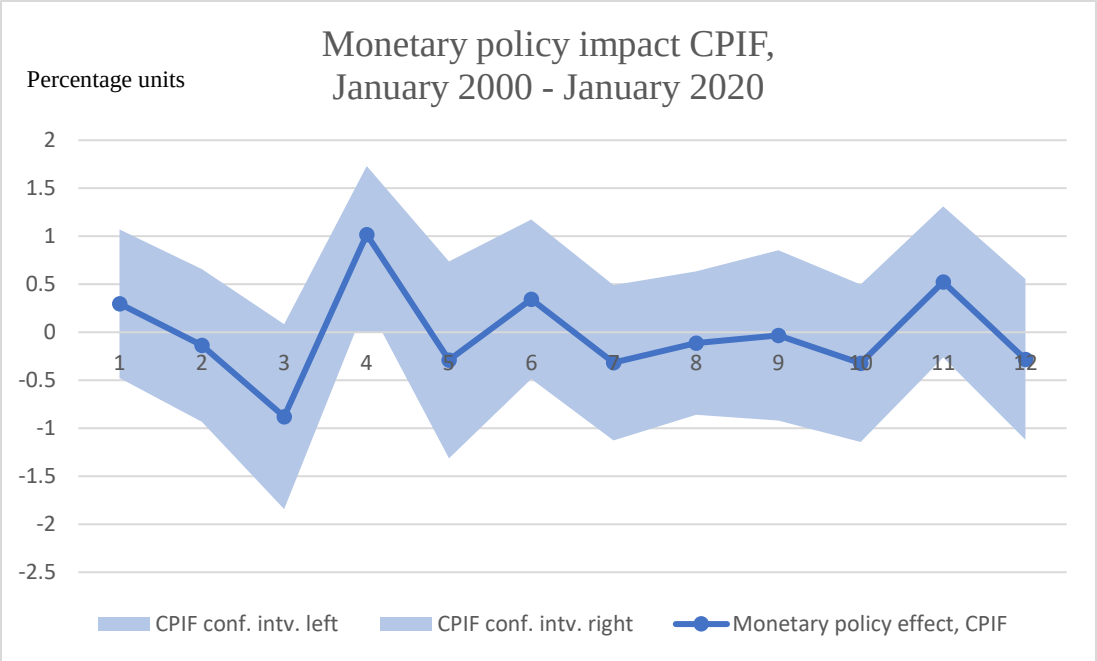


Figure 4.1. Impact of monetary policy on Swedish CPIF changes in percentage points January 2000 – January 2020. Lags h range from 1 – 12. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

Given these results, the overall response of the dependent variables to a monetary policy shock over one to twelve quarters ahead appears to be statistically insignificant. The exceptions consist of the significant response of CPIF and FPI after four and seven quarters, respectively, and of the responses of share prices, which are present between two and four quarters ahead in the time horizon. To further investigate the impact of Swedish monetary policy over the period January 2000 – January 2020, additional results are presented below for each of the respective halves of the sample period, January 2000 – January 2010 and January 2010 – January 2020.

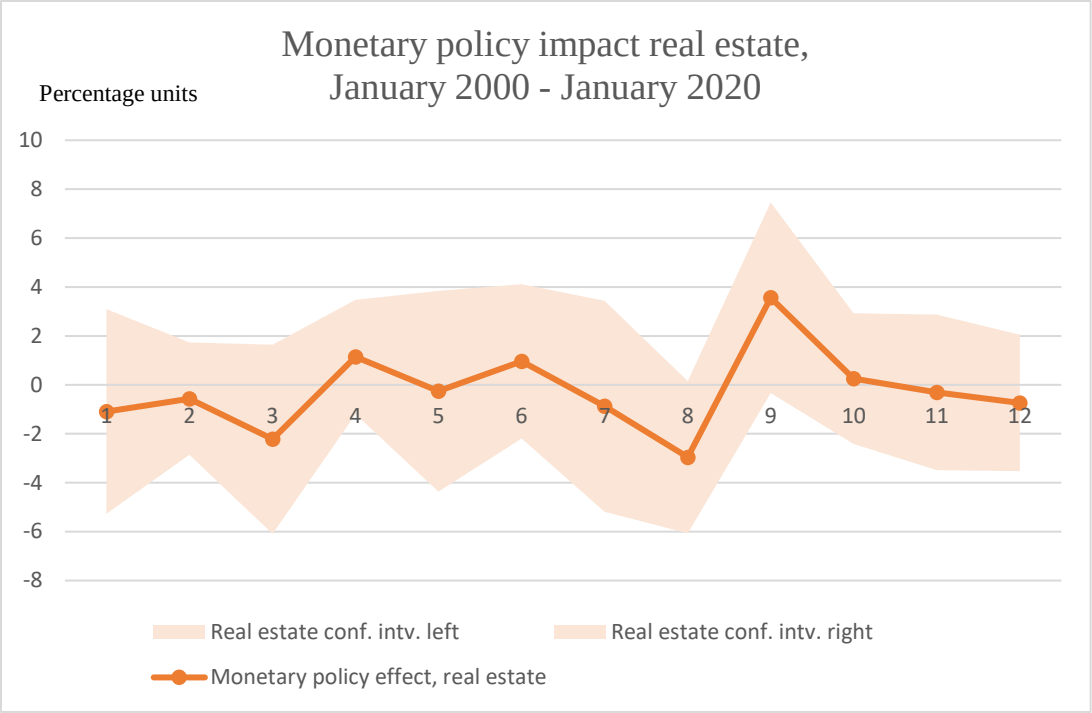


Figure 4.2. Impact of monetary policy on Swedish real estate prices in percentage points January 2000 – January 2020. Lags h range from 1 – 12. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

4.2. Swedish monetary policy impact: January 2000 – January 2010.

The results of a monetary policy shock's reflection in CPIF and real estate prices over the period January 2000 – January 2010 are presented in *Figure 4.3* below. The number of lags has been limited to ten given the small number of observations studied in the sample. The measured responses from CPIF are statistically significant after four quarters, similarly as to before, and the responses from real estate prices are statistically insignificant for the entire period. It appears graphically as if real estate price responses to the monetary shock successively grow over time in value. The responses from CPIF seem to stabilize approximately eight quarters after a monetary policy shock.

The compiled results on the responses of additional price variables are included in *Table 4.4* in the Appendix. EXPI, IMPI, and PPI can all be observed to be statistically significant in their responses to a monetary policy shock after four periods. After this, the responses are statistically insignificant.

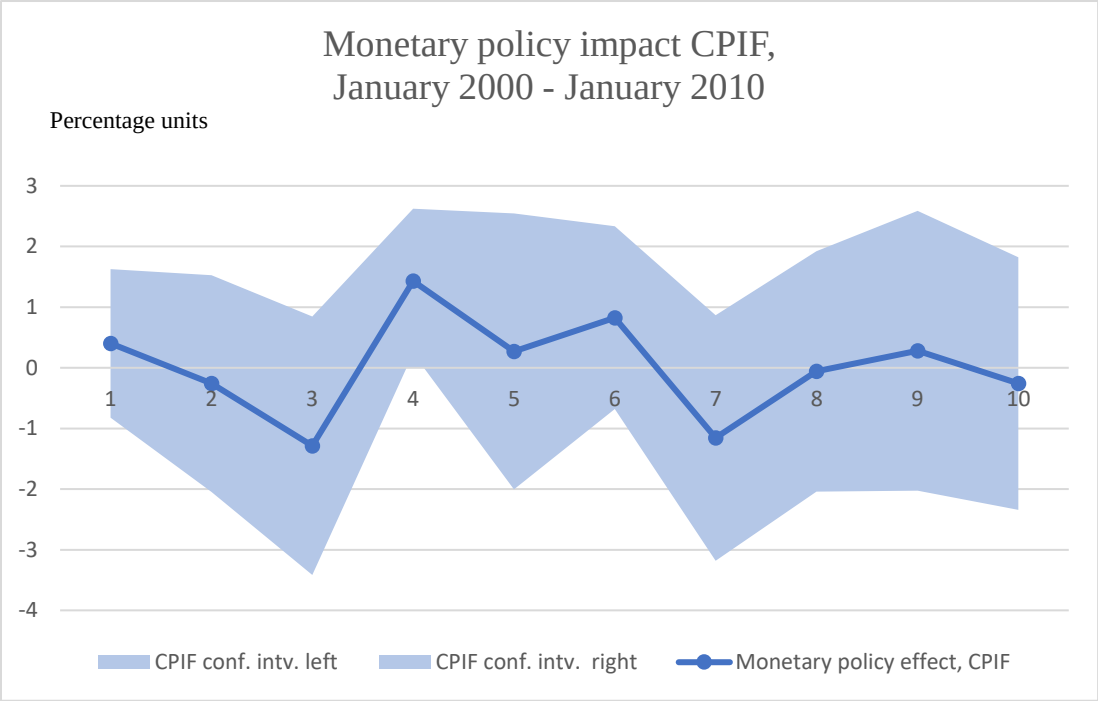


Figure 4.3. Impact of monetary policy on Swedish CPIF changes in percentage units January 2000 – January 2010. Lags h range from 1 – 10. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

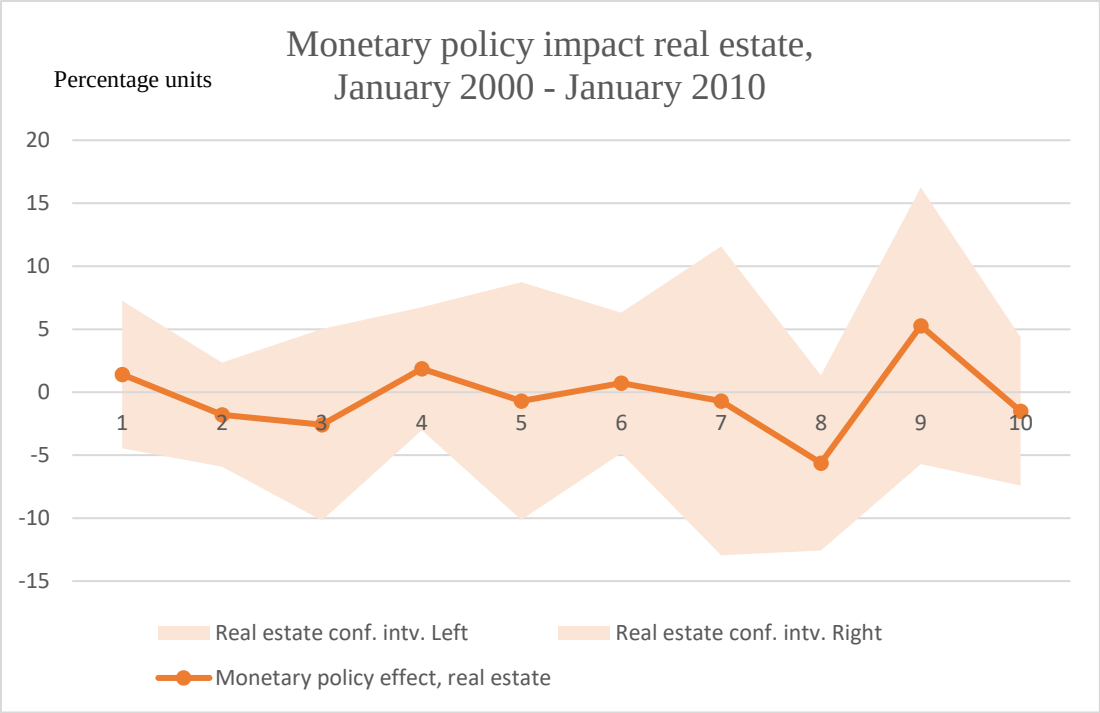


Figure 4.4. Impact of monetary policy on Swedish real estate price in percentage units January 2000 – January 2010. Lags h range from 1 – 10. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

4.3. Swedish monetary policy impact: January 2010 – January 2020.

Figures 4.5 – 4.6 illustrate the impact of Swedish monetary policy shocks on consumer price inflation and changes in real estate prices for the time horizon January 2010 – January 2020. The findings for the influence of Swedish monetary policy on the additional set of studied prices for the time horizon January 2010 – January 2020 are presented in *Table 4.5* in the Appendix. Again, the lags are set to ten given the relatively small number of observations studied.

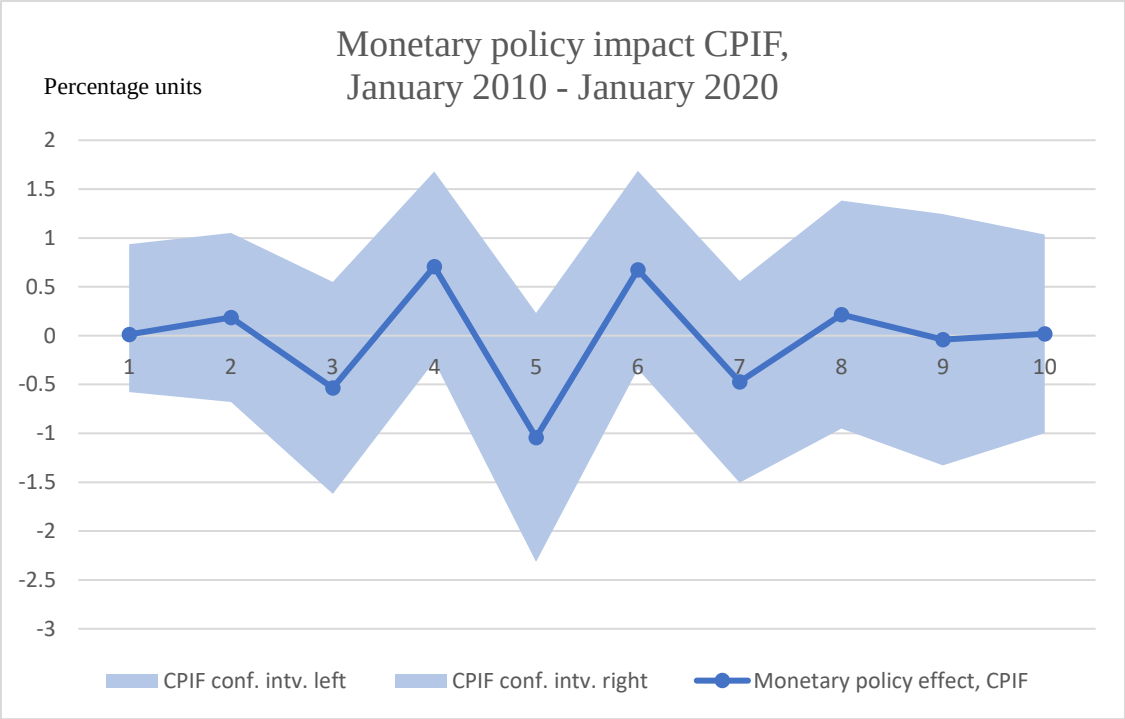


Figure 4.5. Impact of monetary policy on CPIF changes in percentage units January 2010 – January 2020. Lags h range from 1 – 10. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

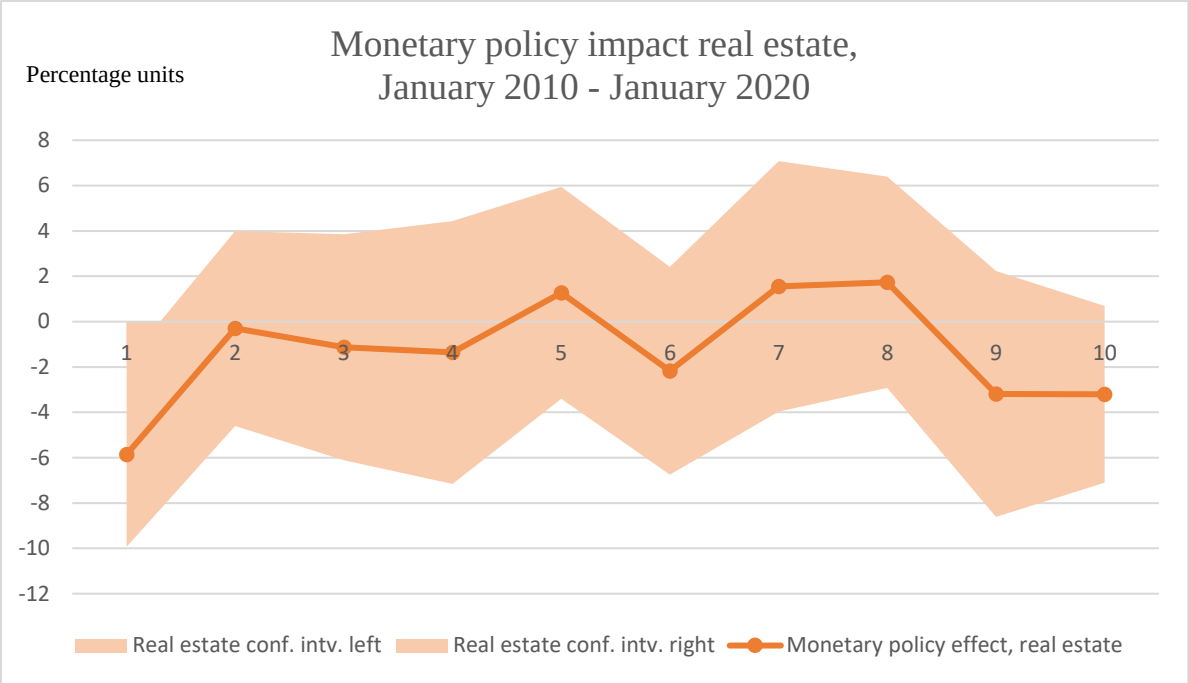
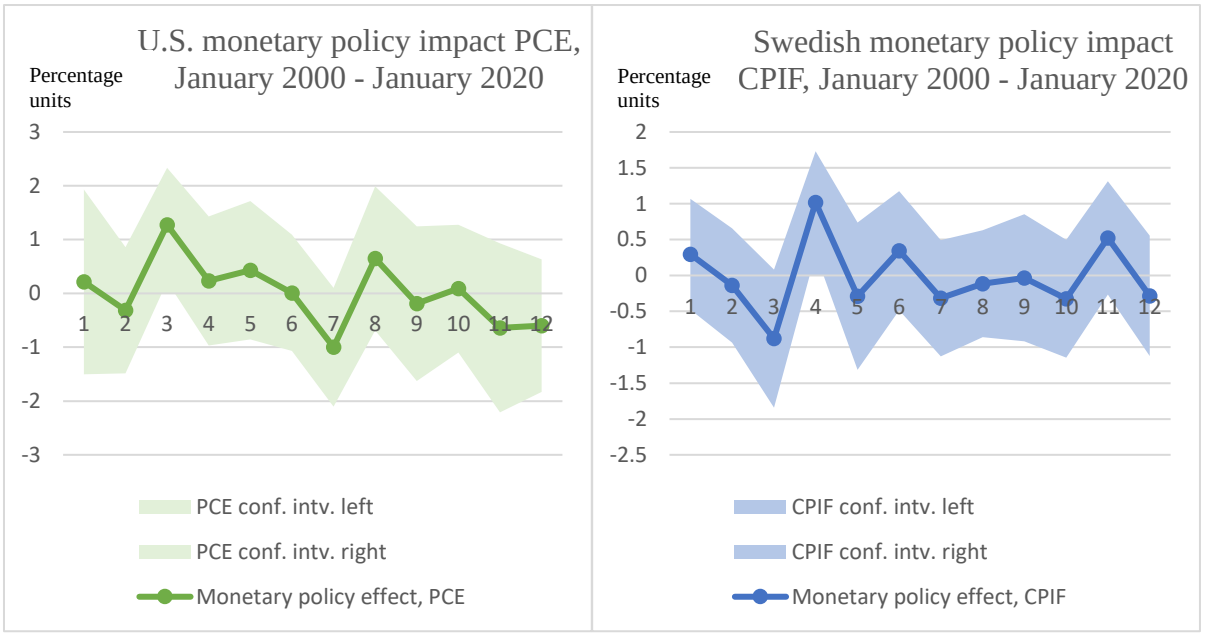


Figure 4.6. Impact of monetary policy on Swedish real estate price in percentage units January 2010 – January 2020. Lags h range from 1 – 10. Each lag measures the impact of a monetary policy shock one quarter ahead. The shaded area consists of a 95 percent confidence interval. Sources: Ekonomifakta (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

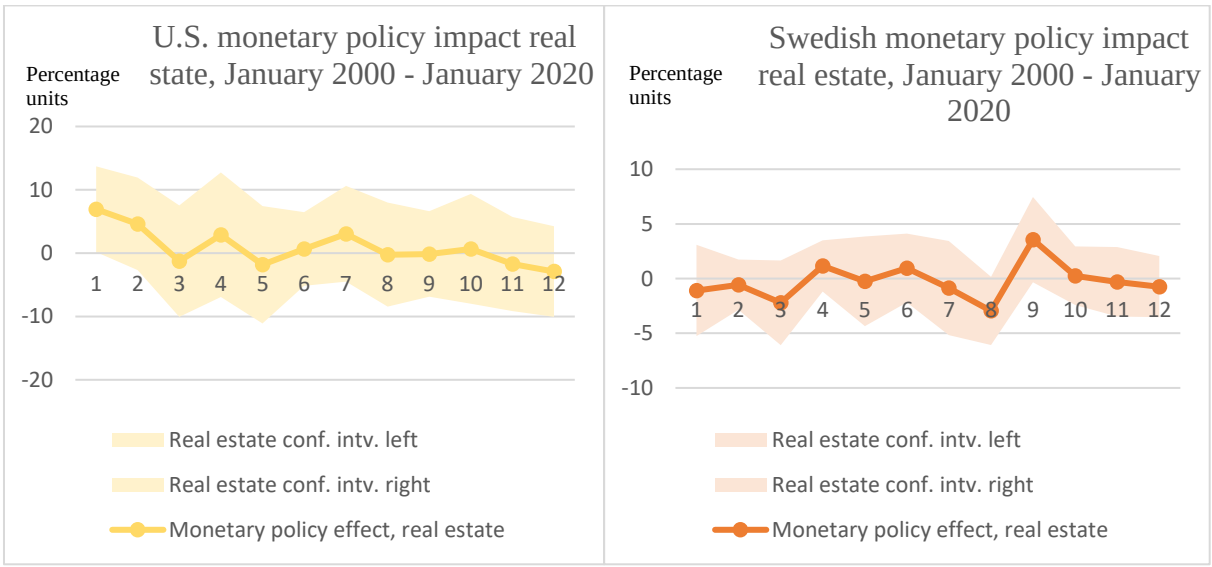
An interesting observation is that CPIF is never statistically significant after a monetary policy shock in this sample period. The shocks do have a highly significant impact on changes in real estate prices after one quarter. This significant effect does not return for the following estimated quarters, yet it appears if the responses of real estate price changes grow in terms of absolute value over the remainder of the studied time horizon. Regarding the findings for the other price indices in *Table 4.5* in the Appendix, the responses from EXPI, IMPI, and PPI were statistically significant three quarters after the monetary policy shock.

4.4. Comparative results: Swedish and U.S. monetary policy impacts

Observing the findings in the comparative setting between Swedish and U.S. monetary policy impact show indications of a similar, decreasing response for U.S. consumer price inflation. Furthermore, the policy effect on real estate prices in both countries appears larger than the impact on consumer price inflation. Yet, in *Figures 4.7 – 10* the responses from U.S. real estate price changes are statistically significant after one quarter. PCE responds significantly to a monetary policy shock after three quarters.

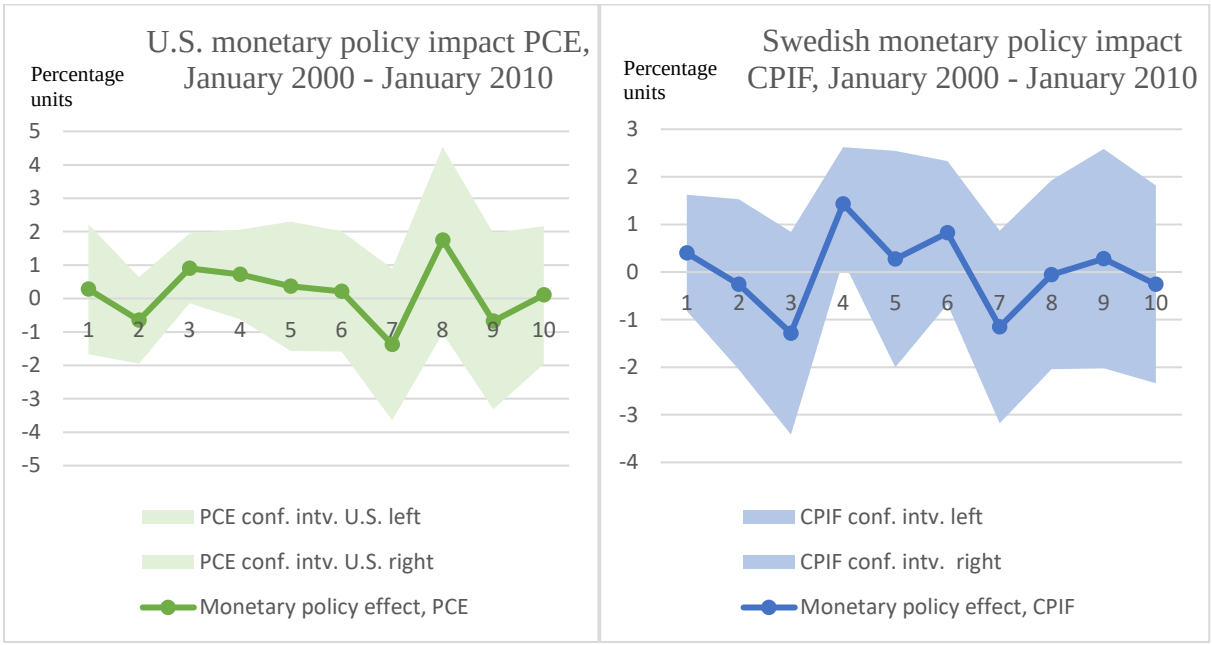


Figures 4.7 – 4.8. Comparison between the effect of Swedish and U.S. monetary policy on consumer price inflation for the period January 2000 – January 2020. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 12 lags. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

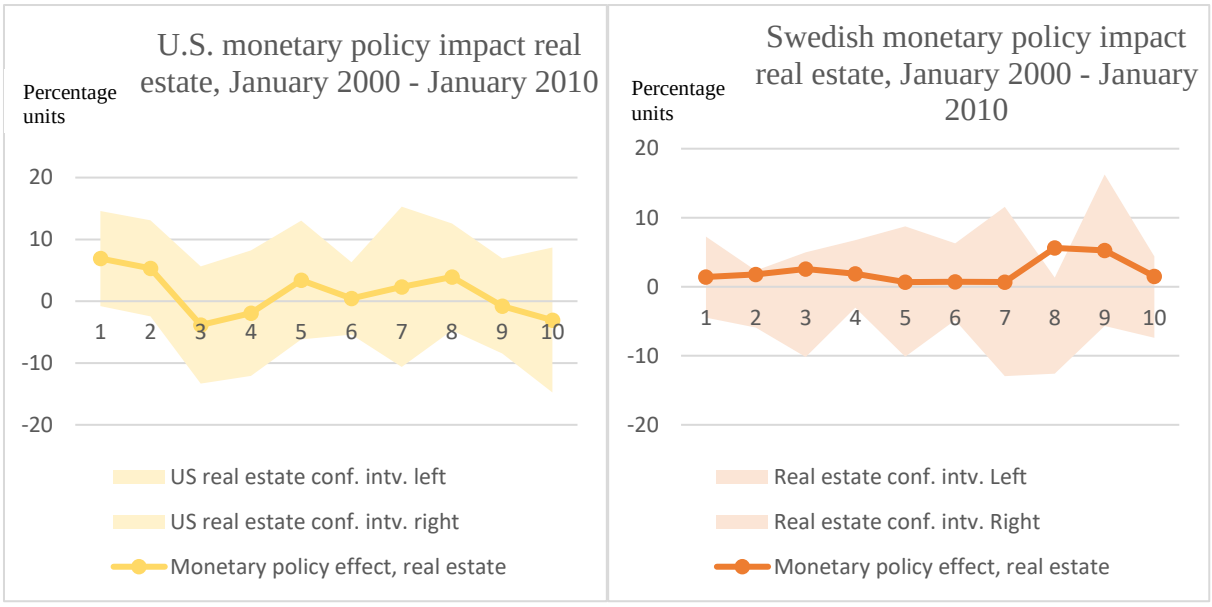


Figures 4.9 – 4.10. Comparison between the effect of Swedish and U.S. monetary policy on changes in real estate prices for the period January 2000 – January 2020. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 12. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

In *Figures 4.11 – 14*, the impact of U.S. and Swedish monetary policy on consumer price inflation and on changes in real estate prices from 2000 – 2010 is introduced. Once more, the changes in real estate prices due to the monetary shocks remain statistically insignificant across this sample period both for Sweden and the U.S. The same holds for the changes in PCE and CPIF, with the exception for CPIF after four quarters.



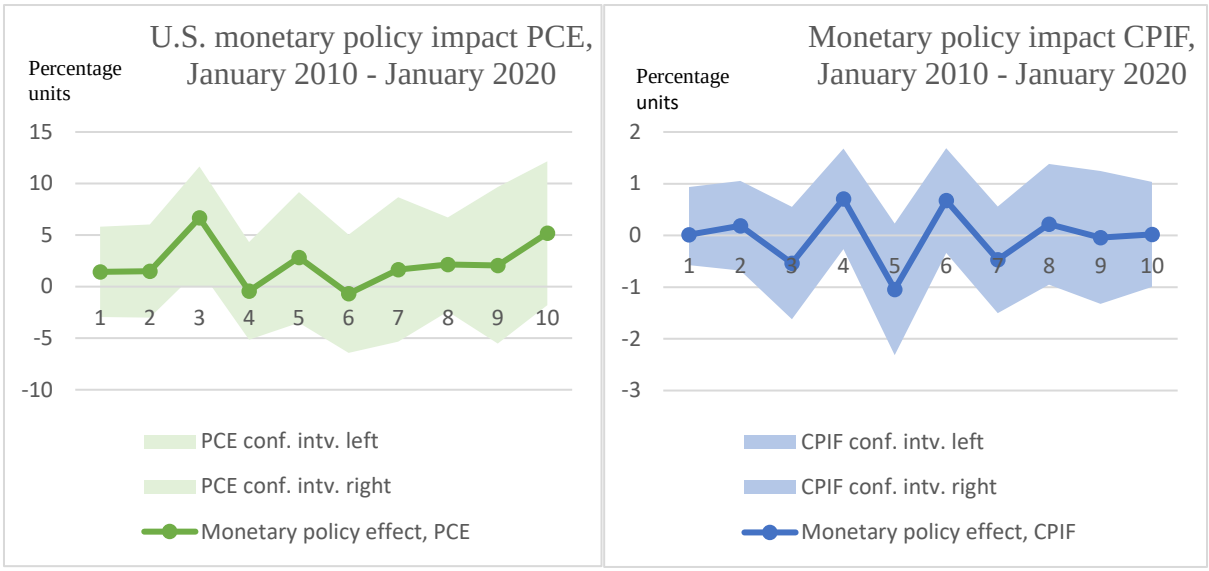
Figures 4.11 – 4.12. Comparison between the effect of Swedish and U.S. monetary policy on consumer price inflation for the period January 2000 – January 2010. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 10. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).



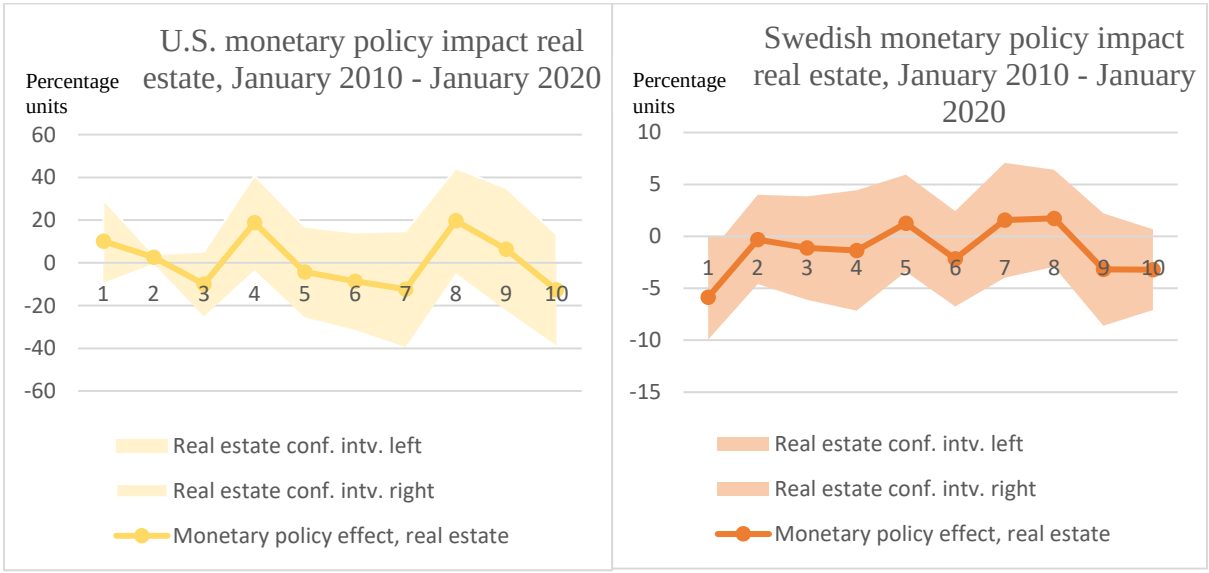
Figures 4.13 – 4.14. Comparison between the effect of Swedish and U.S. monetary policy on changes in real estate prices for the period January 2000 – January 2010. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 10. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

A comparison of the countries' monetary policy shocks between January 2010 – January 2020 in *Figures 4.15 – 18* generates some different findings. Here, PCE responds significantly to a monetary policy shock after three quarters. U.S. real estate prices do not respond significantly at any point during the period. In this sample period, the U.S. real estate price responses are considerably higher compared to the Swedish real estate price responses for the same period if you consider their absolute value.

This concludes the results section of this study. The next chapter will discuss the implications of these findings both for the main question and the hypothesis. This will be followed by a conclusion.



Figures 4.15 – 4.16. Comparison between the effect of Swedish and U.S. monetary policy for consumer price inflation for the period January 2010 – January 2020. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 10. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021



Figures 4.17 – 4.18. Comparison between the effect of Swedish and U.S. monetary policy on changes in real estate prices for the period January 2000 – January 2010. The effect is measured in percentage units. The number of h lags consists of the number of quarters where the impact is observed, where h = 1 – 10. Sources: Ekonomifakta (2021); Federal Reserve (2021); FRED (2021); Riksbanken (2020); Statistics Sweden (2021).

5. Discussion

The purpose of this study was to investigate whether there has been a decrease in the impact of Swedish monetary policy on consumer price inflation and an increase in the impact on housing prices. This implied the formulation of the hypothesis that monetary policy indeed has decreased in its impact of monetary policy on consumer price inflation and increased in its impact on real estate prices.

The estimated findings of this study in the previous chapter indicate that the monetary policy of the Swedish Riksbank appears to fade in its influence on CPIF, as the number of time periods increases over time. Firstly, this builds on the result that while there existed one significant response to the monetary policy during the sample period of 2000 – 2010, this was not the case for the second half of the sample period 2010 – 2020. Secondly, the responses of CPIF also appear to decrease over the whole sample period 2000 – 2020.

In contrast, the effect of a monetary policy shock on real estate prices appeared less clear in terms of its direction. In the first half of the sample period, they become more volatile as the number of studied quarters increases. In the second half of the sample period, the pattern appears reversed with a large initial response fading away, and then successively it starts to increase again. In this second sample period there is one significant response from real estate prices to a monetary policy shock after one quarter.

Another observation from the results for the entire sample period is that the real estate price responses increase highly to a shock after one year and two years, respectively. In addition, a similar response of real estate prices can be seen in the first half of the sample period. In the second half, there is no strong response one year after a shock. However, the responses in this sample period do seem to increase when considering their absolute value two years after the shock.

The findings for Swedish monetary policy impact partly support the main hypothesis. The domestic monetary policy has decreased in impact on the inflation target variable CPIF over time when considering that the CPIF response does not turn significant again after the significant response four quarters in the first half of the sample. It also appears to register a lower absolute value across time. Yet, real estate prices do not seem to have necessarily reacted more over time due to monetary policy. The measured responses from the aggregate and first half of the sample period both present a tendency for the responses to increase as the number of quarters after a monetary policy shock rises. Again, only one significant response was

registered after one quarter in the second half of the sample period. Here, in the second half of the sample period, the real estate price responses show a tendency to slightly increase after two years. However, the fluctuations are lower than the ones registered earlier in the same period and in the previous ones.

For the comparative study with the United States, there are some similarities and differences. The response from PCE was significant after an initial delay of three quarters when studying the entire sample period and appeared to decrease over the number of quarters. U.S. real estate prices also showed a significant response after one quarter from receiving a monetary policy shock. However, the U.S. real estate responses also appear to decrease over time after a monetary policy shock. Splitting the sample period generated different findings for the responses of PCE and U.S. real estate prices to monetary policy compared to their Swedish counterparts. In the first half of the sample, PCE and U.S. real estate prices showed only insignificant responses. This is to be compared to the significant response after four periods for Swedish CPIF. For the second half of the sample, the PCE showed significant changes due to monetary policy three periods ahead, while real estate prices registered no significant response. This is to be compared to the significant response for Swedish housing prices after one quarter in the same period.

Based on the joint results, the main findings of this thesis remain clear: Consumer price inflation appears to respond less to monetary policy shocks across time in the case of Swedish CPIF in all the studied sample periods. However, this trend seems less certain for the U.S. consumer price inflation, where the responses do not show a similar decreasing trend over time. In fact, the responses of PCE to monetary policy shocks seem to start increasing again at the end of the second half of the sample period, a trend that also holds for U.S. real estate prices. Regarding the latter, Swedish real estate price responses show a relatively unclear trend concerning whether they are rising or decreasing. They appear to be larger in absolute value in the second half of the sample compared to the responses in the first half. However, the largest response appears at the beginning of the second half of the sample period. A similar, relatively unclear trend can be seen for U.S. real estate prices in the second half of the sample period, who respond strongly at the start of the sample period, followed by milder responses, and then sharper ones.

Thereby, provided that the findings were not fully conclusive regarding the real estate prices, the main hypothesis is partly accepted. There appears to have been a decrease in the influence of Swedish monetary policy on the domestic consumer price inflation over the sample period

January 2000 – January 2020. Yet, it is less clear whether there has been an increasing impact on real estate prices for the same sample period.

When it comes to the unexpected findings for the responses of real estate prices, these may be explained by potential weakness in the method based on local projections. One such weakness is the suggestion of serious small-sample bias within this method (Brugnolini, 2018). This is presented by comparing local projections with and without controls (Herbst & Johannsen, 2020). Adding to that, for the results obtained for each of the two halves of the sample period, the sample was cut in half. This means that the relatively high lag orders in these sample periods will have to be more carefully interpreted, given the presence of small-sample bias.

In addition, there are also presented results that bias is inherent within local projections as impulse responses increase when measured over longer time horizons (Herbst & Johannsen, 2020). This influenced the choice of the number of *h* lags to be limited to 1 – 12 quarters. All in all, the introduced findings suggesting local projections suffer from bias could prove a source to the unexpected behavior of the real estate prices.

Another factor that may have influenced this unexpected result may be the choice of using quarterly data in this study. Jordà (2005), who used monthly data, may achieve a decrease in small sample bias according to Herbst & Johannsen (2020). Yet, they assert that the issue of small sample bias remains even when breaking down the data further (Jordà, 2005; Herbst & Johannsen, 2020).

The potential influence of a Cantillon Effect, which enables a rising response from real estate prices at the expense of lower responses of consumer price inflation, may be present. It is still possible that it has occurred at the expense of less responsive consumer price inflation. Yet, returning to the main hypothesis, it remains unclear whether the responses of the real estate prices have increased over time. The results from Sweden show that responses to shocks from real estate prices have started to rise in the latter part of the sample period, January 2010 – January 2020. This indicates that a Cantillon Effect may have been present in dampening the response of consumer price inflation and stimulating real estate prices over time. However, it is difficult to distinguish whether the responses of housing prices are becoming larger over time, which makes the potential presence of the effect more uncertain.

Compared to the related research within this field, the results prove in line with the appearing trends of fading influence of domestic monetary policy on domestic inflationary series. The previous studies that have emphasized that the globalization of inflation is becoming a more

present phenomenon will be reinforced based on the results in this study. This is related to the findings' indications that the impact of monetary policy on domestic inflation in Sweden appears to decrease, with an opposite trend in the U.S. with stronger responses from PCE. A potential factor behind this may be constituted that Sweden is rather following the inflation pattern in a large economy, such as the United States, over the studied sample period. This could potentially indicate support for the impact of globalization on the effect domestic monetary policy has on domestic inflation.

Examining the Swedish results also gives rise to support for the suggestions of a flattening of the Phillips curve. Despite the attempts of expansionary monetary policy from the Swedish Riksbank to boost the economy, especially over the second part of the sample period, the consumer price inflation developments remain modest. This is contrary to the implications of the Phillips curve, which indicates that its proposed effects for inflation have been weakened.

The format of this study is unique with respect to its methods of studying the development of domestic monetary policy and its effect on domestic inflation. The study decided to use a combination of local projections and the measure developed by Romer & Romer (2004) in its attempt to measure the impact of monetary policy shocks on inflation. This adds to its specific niche and shows that this can be a relevant setup for future studies within the same field. Furthermore, the study bolsters the suggestions of previous research regarding a drop in the impact of monetary shocks on consumer price inflation. It suggests that the Cantillon Effect becomes a potential contributing factor to such a development, which, to this study's knowledge, is an explanatory factor that has not been used for this specific area of research.

Limitations of this thesis include the sample period studied regarding developments in monetary policy. This was based on the limited duration of the concerned monetary policy regime in focus, as Sweden first introduced an inflation target in 1993. An initial learning period for the new regime up until 2000 meant that the data was confined to the beginning of the 21st century (Andersson & Jonung, 2018). Furthermore, the Corona pandemic has played an important role in limiting the selected upper limit of the studied sample period. The motivations lie in the potential noise in responses of the economy to such a global event. Given the limited sample period, longer economic trends that could help clarify the fading influence of monetary policy on consumer price inflation are excluded. In addition, the uncertainty of future economic developments implies that these results are not generalizable for what lies ahead.

Additional limitations consist of the analysis of the studied research problem and the inference drawn from the estimated results. The potential theoretical factors considered to explain a change in the impact of Swedish monetary policy are limited to the flattening of the Phillips curve, expectations, globalized inflation, and the proposed use of the Cantillon Effect. Given the rich literature of potential influences behind decreasing monetary policy impact, the study was forced to restrict itself to a limited number of explanatory factors.

Clearly, this study was restricted in studying the impact of monetary policy in Sweden compared to the United States. This may also impact the generalization of this study, given the specific characteristics of the Swedish economy and that this may not be a fit for many different economies. The study was also limited in the depth of its investigation given its focus on how price indices were affected by monetary policy shocks. The motivation of the specific prices was based on the selection of these in the database of Statistics Sweden (2021). This is only one of several relevant indicators in business cycles that could be considered (Statistics Sweden, 2021).

However, the findings of this study for a developed country such as Sweden may prove generalizable to some extent for other developed countries. Given the importance of the EU for the Swedish economy and its influence on Swedish monetary policy, the results of this study could prove generalizable for other EU members. Predominantly, it could be used as a benchmark for countries outside the Euro Area who try to conduct their own domestic monetary policy alongside the ECB. The generalizations could also stretch towards the impact of monetary policy on real estate and consumer price inflation during the 21st century in other countries which fit the description of a developed, open, and small economy.

One strong aspect of this study is the broad audience who can make use of its implications in a more practical setting. This audience naturally includes the forecasting and policymaking of central banks as well as governmental institutions. Additional areas that could benefit from these results include financial institutions, such as banks, who remain vigilant on the developments in monetary policy. It can also be useful for the average consumer in the economy, especially for the current generation of young people who are finishing their education and are attempting to establish themselves in the labor market. Their decisions for loans and investments in housing and other assets can be supported by studying the impact of monetary policy on real estate price changes.

The results of this thesis provide important and intriguing questions to explore further. Firstly, in this study, the Cantillon Effect between consumer price inflation and real estate price inflation has only been studied to a limited extent given its focus on real estate and consumer price inflation. Future studies could therefore investigate other sections of the economy and study if they can contribute to explanations behind recent trends in Swedish inflationary developments.

Secondly, given some unexpected impulse responses of real estate prices to monetary policy, future research may want to extend the insights of such uses of local projections. Provided the strong presence of VAR models in the research on monetary policy, the competitiveness of local projections should be evaluated to improve their usage in future studies.

Thirdly, given the large population concerned about the influence of monetary policy on domestic inflation, future research needs to continue to cast light on this area of study. The factors causing a change in central banks' ability to affect consumer price inflation, and most certainly real estate prices, need to be evaluated. The impact on real estate prices stands out in the sense that this concerns a market with vast meaning for a large share of actors in the economy. In order to support them in their economic decision-making, future studies need to continue to investigate the ability of central banks to achieve their objectives of price stability and financial stability.

6. Conclusion

Monetary policy conducted by independent central banks has been claimed in the related research field to falter in its accomplishments. This study supports these claims by presenting evidence of a fading impact of the monetary policy conducted by the Swedish Riksbank on domestic consumer price inflation. The impact on asset prices remains relatively unclear, with weak signs that it may be increasing over time. A different result can be viewed in the world's largest economy, the United States. Here, monetary policy shocks generate seemingly stronger responses from consumer price inflation, while real estate price responses remain more unclear.

Furthermore, based on the achieved results, a Cantillon Effect could potentially explain the development of the responses of Swedish consumer price inflation and real estate prices. However, the relatively unclear results for real estate prices make the feasibility of such an effect more uncertain. Additional factors behind the findings may be constituted by global inflationary trends related to monetary policy in the global economy, as well as the flattening of the Phillips curve.

Based on the unexpected outcomes for some of the results, particularly for real estate prices, future research should direct its efforts to investigate appropriate econometric methods for studying the impact of domestic monetary policy on domestic inflation. It should extend the potential range of explanatory factors behind fading monetary policy impact on domestic inflation, for example by studying the potential influence of Cantillon Effects. Finally, future studies should continue to investigate the developments in the influence of monetary policy on consumer price inflation, and in particular real estate prices. This is imperative, both for policymakers and hence for the average consumer in the economy.

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Appendix

Table 4.3. The impact of monetary policy shocks measured in percentage units, January 2000 January 2020, with lags h=1,…,8. The values within parentheses are robust standard errors. Source: Statistics Sweden (2021), Ekonomifakta (2021), FRED (2021).

Dependent variable	h=1	h=2	h=3	h=4	h=5	h=6	h=7	h=8
Shares	-841.09	2097.3*	-2591.9*	2331.5*	-1106.1	1210.4	-699.2	-1272.1
	(729.5)	(902.0)	(1039.3)	(1119.7)	(941.0)	(1163.5)	(1149.8)	(966.3)
EXPI	-0.1501	0.2525	1.9398	0.3821	-1.2021	-0.3442	-1.6031	-1.5294
	(1.3638)	(1.3252)	(1.4363)	(1.6257)	(1.4891)	(1.3292)	(1.3501)	(1.3585)
IMPI	0.0953	0.4194	0.1701	1.4702	-1.7711	0.8311	-3.0644	-0.7553
	(2.0988)	(1.9419)	(2.1864)	(2.1288)	(2.4742)	(2.0108)	(1.9370)	(1.8822)
PPI	0.8299	-0.7721	0.3790	1.7052	-1.9147	0.1289	-1.6671	-0.3285
	(0.9759)	(1.1696)	(1.2126)	(1.1138)	(0.9748)	(0.9654)	(1.0369)	(0.9035)
FPI	-0.1057	1.1399	-1.4498	0.0513	2.3836	-2.7196**	1.6040	-1.4324
	(0.8854)	(0.9077)	(-1.0177)	(1.3025)	(1.4386)	(0.9633)	(2.1998)	(1.5934)
p<0.05*, p<0.01**, p<0.001***								

Table 4.4. The impact of monetary policy shocks measured in percentage units, January 2000 – January 2010, with lags h=1,…,8. The values within parentheses are robust standard errors. Source: Statistics Sweden (2021); Ekonomifakta (2021), FRED (2021).

Dependent variables	h=1	h=2	h=3	h=4	h=5	h=6	h=7	h=8
Shares	-737.85	2532.22	-3924.47	3481.74	-3179.88	4356.02	-3972.80	-693.05
	(731.31)	(1439.98)	(2287.69)	(2549.03)	(1959.44)	(2747.17)	(2489.46)	(2457.26)
EXPI	-1.3869*	3.4859	-2.9032	3.9171*	-2.4405	1.2347	-3.1226	1.0980
	(2.1137)	(1.9558)	(1.6249)	(1.7898)	(2.1388)	(3.0747)	(2.3030)	(2.2467)
IMPI	-0.2774	2.7299	-6.5585	7.1201*	-5.0198	0.7353	-5.8888	4.7144
	(3.3527)	(3.4925)	(4.0951)	(3.1633)	(3.9721)	(3.4790)	(4.1103)	(3.1400)
PPI	-0.1149	1.8975	-3.2673	4.2699*	-2.6824	0.8784	-3.8483	1.9122
	(1.5323)	(1.3446)	(1.6901)	(1.4171)	(1.5897)	(1.6223)	(1.8647)	(1.7394)
FPI	0.9863	-1.1414	-1.1990	0.5500	1.8869	-0.2732	-2.7774	-0.6300
	(0.9979)	(0.9083)	(1.3919)	(1.0590)	(1.8732)	(0.9505)	(2.0297)	(0.8064)
p<0.05*, p<0.01**, p<0.001***								

Table 4.5. The impact of monetary policy shocks, January 2010 – January 2020, with lags h=1,…,8. The values in parentheses are robust standard errors. Sources: Statistics Sweden (2021); Ekonomifakta (2021); FRED (2021).

Dependent variable	h=1	h=2	h=3	h=4	h=5	h=6	h=7	h=8
Share prices	-402.181	1773.948*	-520.731	615.8769	224.1435	-577.763	986.6768*	-1272.01
	(1037.717)	(726.1076)	(620.9083)	(675.254)	(569.8625)	(581.682)	(442.3869)	(677.8601)
EXPI	2.531472	-3.60309	9.123669**	0.078955	-2.49153	-6.00835	-2.36861	-5.43166
	(2.438048)	(3.116798)	(2.565577)	(2.803189)	(3.409629)	(3.110735)	(2.903772)	(3.575587)
IMPI	0.900518	-2.39517	9.28377**	0.330022	-5.35889	-2.16722	-2.02207	-6.33341
	(3.537007)	(3.490754)	(3.182881)	(2.971636)	(3.515483)	(4.344063)	(3.581928)	(4.044066)
PPI	3.035173	-3.49249	4.833341*	-0.01922	-1.78948	-1.89021	-2.10908	-3.41689
	(1.681981)	(1.921256)	(1.874672)	(2.324034)	(2.188031)	(2.221304)	(2.3849)	(2.208114)
FPI	-0.46609	2.906169	-0.26101	-1.1766	2.369699	-1.28672	0.061203	0.59444
	(1.471611)	(1.83774)	(1.690542)	(1.985951)	(2.656077)	(2.393197)	(1.722719)	(1.345606)
p<0.05*, p<0.01**, p<0.001***								